Geol Survey

A guide to the geology of the Middle Illinois Valley–Putnam, Marshall, and Peoria Counties, Illinois

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The geologic framework

A picture of the area. If a long, deep trench were dug east-to-west across the Middle Illinois Valley, we could see in its sides the layers of earth and rock that lie under the land surface. Figure 1 shows just such a trench side view across the valley at Henry, Stop 3 on the field trip. This kind of drawing is called a geologic section. In it the different patterned areas represent the different earth and rock layers that lie within about 500 feet of the land surface.

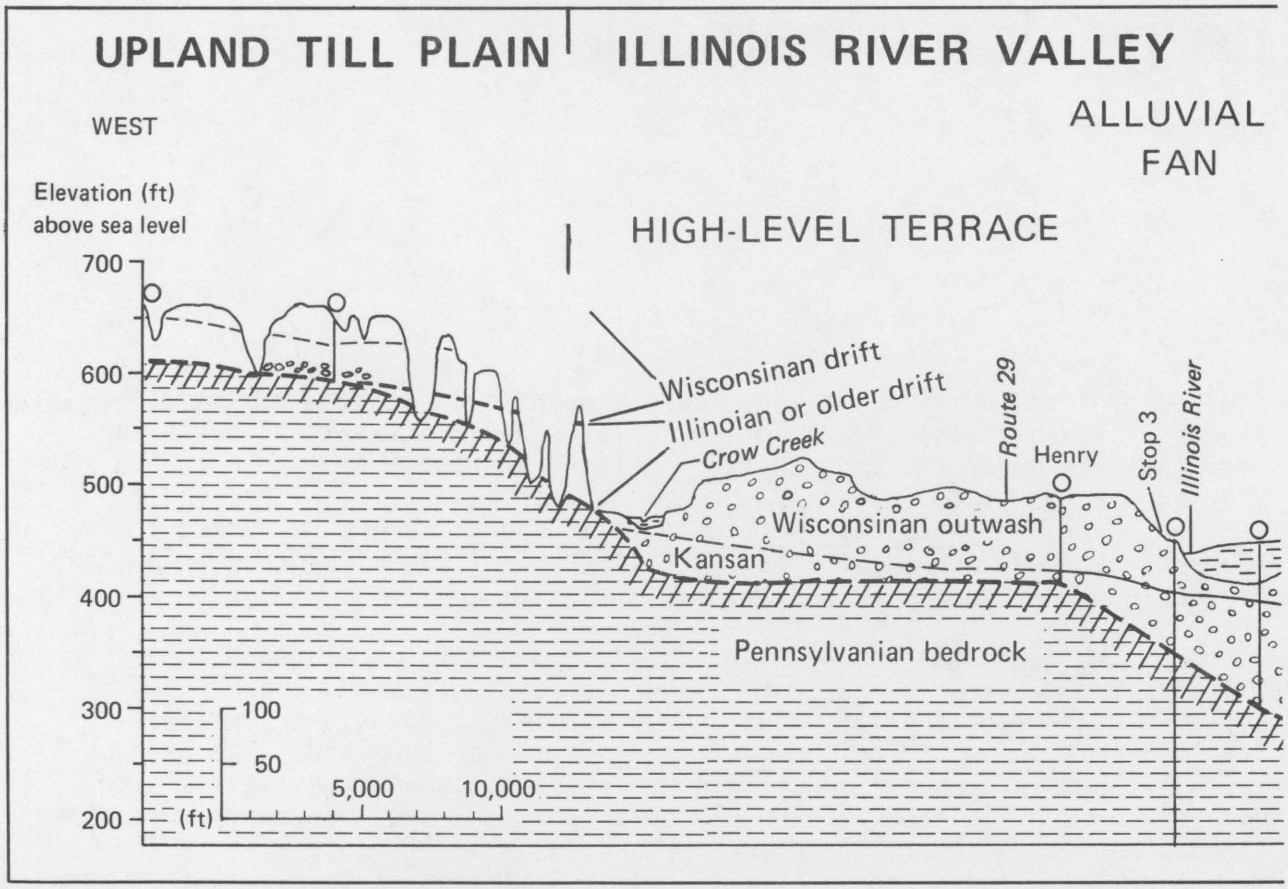
We can summarize what this picture shows us about the Middle Illinois Valley area in this way: layers of clay, sand and gravel, and gravelly mud—glacial drift deposited by glaciers and their meltwaters—cover Pennsylvanian bedrock and form the surface of the land. The land surface shown in figure 1 consists of the wide Illinois River Valley with uplands on each side that are deeply notched by the many narrow valleys of streams running down off the higher ground into the Illinois River. The smoother, less-eroded glacial plains only a few miles farther away from the valley sides are not shown in the figure.

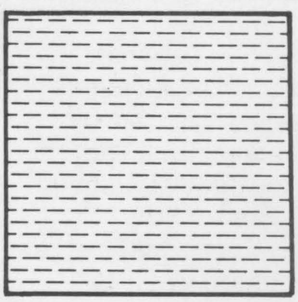
Like the rest of the northeastern quarter of Illinois, the present land surface of the field trip area is young. It has been shaped mainly by glaciers, glacier meltwaters, and the run-off of rain and snow water. The principal landform—the present day Illinois Valley—began forming only about 16,000 years ago. By this time the last glacier to cover the area that became the Middle Illinois Valley had probably melted off it. Then, meltwater streams from the active glaciers not far to the east of the present valley area could drain southward through the area. In the time between about 16,000 and 13,000 years ago, these high, voluminous meltwater flows made the valley we see. (By about 13,000 years ago the last glacier had melted back into Lake Michigan, and large meltwater flows were no longer coming down the Illinois Valley.)

The flows of meltwater cut the valley into the deposits of the glacier, then partly filled the valley with sand and gravel, and later cut wide channels down into these deposits. The evidence for this history is the different floodplain land surfaces that are found in the valley at different elevations between the levels of the present river's floodplain and the upland glacial plain.

COVER: A photograph of the Illinois Valley and the old dam site at Henry. Taken looking north from the Route 18 bridge.

Figure 1. Geologic section showing land features and earth materials in the Illinois Valley at Henry (vertical exaggeration 40x).

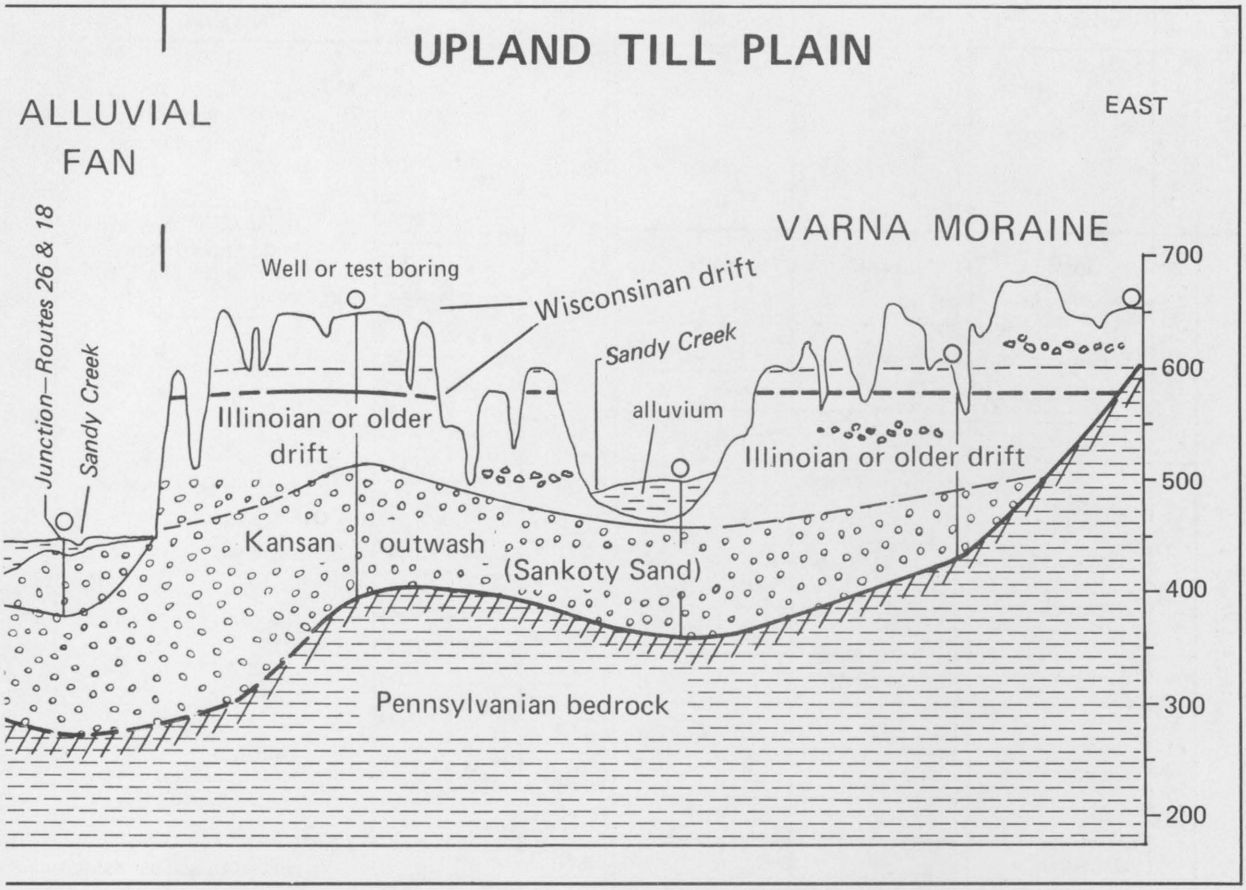




Pennsylvanian bedrock. In the field trip area the solid rock, or bedrock, under the glacial drift consists of thick layers of mudstone and sandstone with thinner layers of coal and limestone between them. These are sedimentary rocks, which were once sediments—soft, loose muds and sands. The sediments were deposited during the Pennsylvanian Period, the time between about 320 and 280 million years ago.

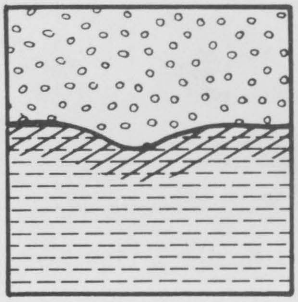
During the Pennsylvanian Period, Illinois and most of the midwest were part of a tropical region that was covered by shallow seas bordering swampy, forested river deltas and river floodplains. The region was in a part of the Earth's crust that was sinking very slowly, in such a way that an area in it was repeatedly and alternately covered by shallow seas and by swampy land. The muds and chalky mud mixed with shell sand that accumulated in the seas became mudstone and limestone beds. The muds, sands, and thick peat beds that accumulated in the deltas and floodplains became mudstone, sandstone, and coal beds. The repeated alternation of marine and lowland sediments can be seen in the Pennsylvanian bedrock in the area.

The Pennsylvanian bedrock has provided important mineral resources for the area's people. Since the mid-nineteenth century, small quantities of groundwater, brick clay and limestone, and large quantities of coal have been taken from it. The thickness of the Pennsylvanian rocks ranges from about 300 to 400 feet in the field trip area.



Below the Pennsylvanian rocks are older layers of mudstone, dolomite, and sandstone, which are shown in figure 2. The sediments that formed these rocks accumulated on the floors of Paleozoic seas that began to cover the midcontinent during the early part of the Paleozoic Era, which began about 570 million years ago. The Paleozoic rocks covered a landscape carved in Precambrian granites that were formed between about 1.5 and 1.2 billion years ago. Note that the 5000 feet of Cenozoic drift and Paleozoic rock shown in figure 2 represent only about the last 13 percent of the theoretical age of the Earth—about 4.5 billion years. Also the 5000 feet of rock and earth are just about 1/4200 of the Earth's radius, which is 3,960 miles.

The older Paleozoic rocks have not provided resources in the field trip area, being too deep to quarry, apparently barren of petroleum and natural gas, and generally containing water that is too salty and mineral-laden to use.



Pennsylvanian-Pleistocene unconformity. The cross-hatched line drawn on top of the Pennsylvanian bedrock outlines the bottom and sides of the Ancient Mississippi Valley. Today's Mississippi River was diverted west from this valley into its present course when the last glaciers to flow across the area (the Wisconsinan glaciers) blocked the valley. The cross-hatched line also representes an unconformity—the surface of contact between glacial deposits no more than a few hundred thousand years old and bedrock about 300 million years

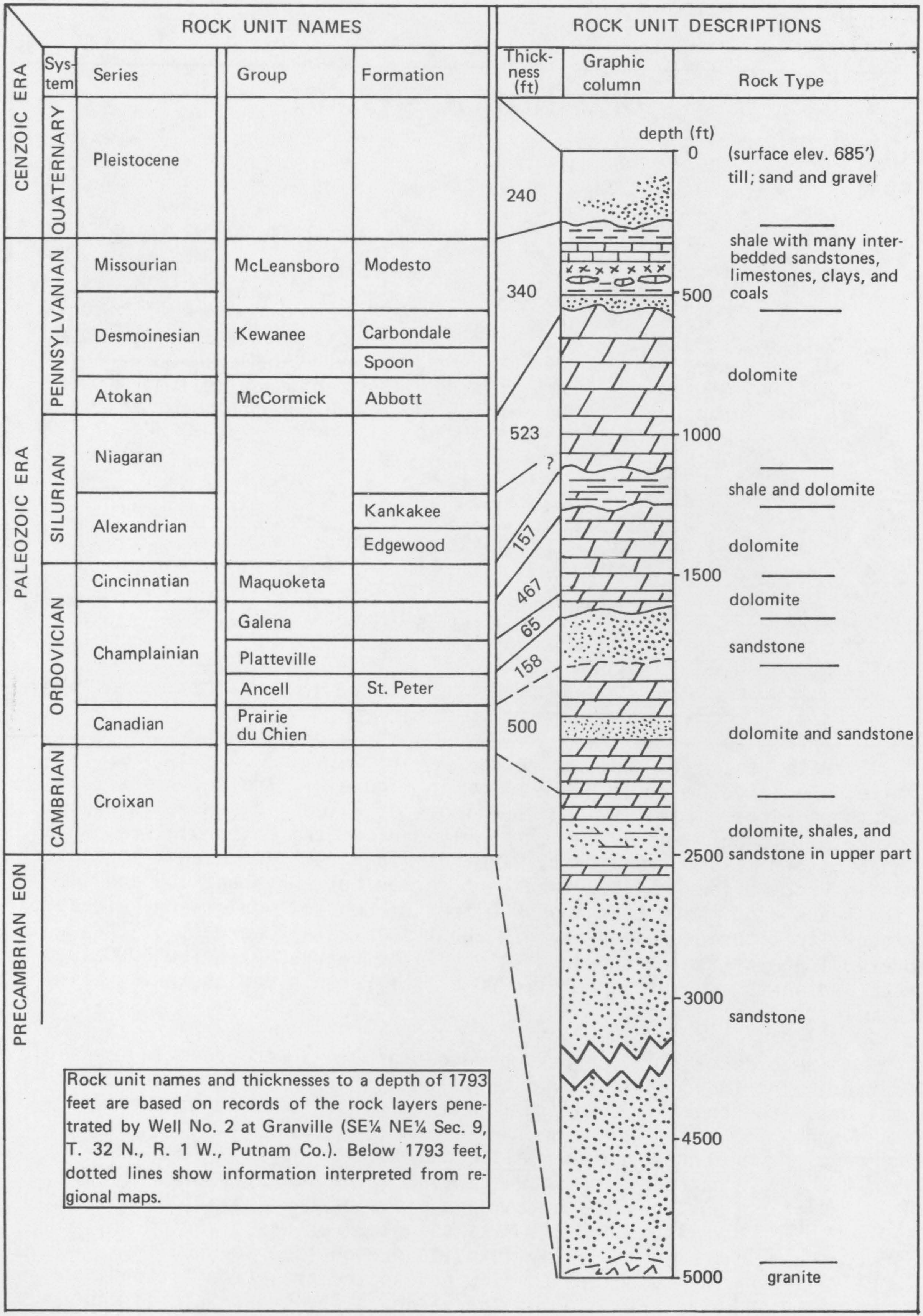
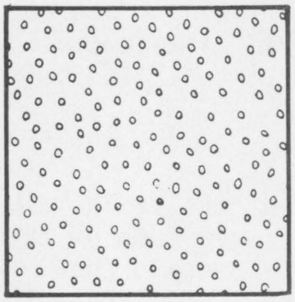


Figure 2. Ages, names and descriptions of the bedrock units under the Middle Illinois Valley Region.

old. If we think of the layers of sediment and rock in the Earth's crust as pages in a book telling the geologic history of the Earth, then unconformities are missing pages that were never written or pages that were torn out of the book by erosion.

In this area, perhaps 200 million years of erosion wore away several thousand feet of rock and finally cut the Ancient Mississippi Valley. As figure 2 shows, there is also a major unconformity between the Silurian and Pennsylvanian Systems where layers of Devonian and Mississippian rocks, which are present in nearby areas, are missing.



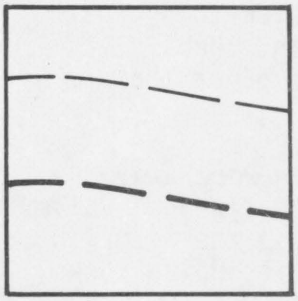
Glacial drift: outwash. Figure 1 shows that at Henry only about half of the width of the Ancient Mississippi Valley is occupied by the Illinois Valley and that more than half its depth is filled with outwash. Outwash is the sand, gravel, and other sediment that meltwater "washes" out of the ice field and deposits away from it.

Three large outwash deposits from different glaciations partly fill the Illinois Valley and the Ancient Mississippi Valley. The Sankoty Sand, which fills the bottom of the bedrock valley, is the oldest deposit and is identified as outwash of the Kansan glaciation, the second glacial stage. In the deepest part of the buried Ancient Mississippi Valley, the Sankoty Sand is over 100 feet thick (McComas, 1969). The Sankoty Sand is found in the buried valley from Putnam County south to Tazewell County, and it is the major source of water in this region.

Above the Sankoty Sand, in the east bluffs of the valley, are sand and gravel deposits identified as outwash of the Illinoian (third) glaciation. The most recent outwash is Wisconsinan in age and forms the high-level and low-level terraces in the present valley. The field trip route map shows these deposits. Illinoian and Wisconsinan Outwash gravels are mined in the area for construction and surfacing materials.

The Kansan and Wisconsinan outwashes—and probably the Illinoian as well—are valley trains. Valley trains are long, narrow outwash bodies that partly fill stream valleys carrying meltwater away from glaciers. The presence of three valley trains in the Middle Illinois Valley indicates that the Ancient Mississippi Valley—even though over-ridden and buried by several glaciers—made a persistent depression in the land surface that meltwaters of at least three glaciations followed.

Sand and gravel in the outwash and buried in the till sheets of the uplands provide supplies of water. Below depths of a few feet or tens of feet, the drift and the bedrock below it are saturated with ground water, which is snow water and rain that has soaked into the ground. Although all types of drift can contain water, only the sand and gravel deposits readily yield large volumes to wells. Water flows easily through the visible spaces—the pores—between the grains of moderately clean sand and gravel. In contrast, water flows much more slowly through the microscopic pore spaces in clayey drift deposits such as till.



Glacial drift: till. Till is the sandy, gravelly mud carried and deposited by glaciers. Till can be laid down under a glacier or it can accumulate on the melting surface of the ice and be let down to the ground. A typical till is hard and compact mixture of all sediment sizes: mostly clay, silt, and sand with smaller quantities of pebbles, cobbles, and boulders. Often each glacier left a till sheet that has a distinctive and identifiable color and composition.

The glaciers that entered Illinois and the Middle West at different times during the past several million years were the broad flowing edges of continental ice sheets that grew across Canada when the world climate cooled. The south-flowing edges of the Canadian ice sheets advanced into Illinois from the northwest and northeast. The glaciers in Illinois are estimated to have been 3,000 to 5,000 feet thick.

Two different tills were deposited on the surface of the field trip area during the Wisconsinan glaciation. The uppermost till over much of the area is the Malden Till Member, which is a silty gray till. Beneath the Malden lies the Tiskilwa Till Member, which is a silty, sandy, pinkish till. Both units are members of the Wedron Formation. Beneath the Wisconsinan tills lie Illinoian and older drift.

Deposits left by glacial ice and meltwater—glacial drift—cover about 90 percent of Illinois and form a vital resource. Glacial drift supports our constructions and supplies much of our water, sand, gravel, and brick clays. It is the parent material for much of our soil and the container for our solid and liquid wastes. The level terrain that the glaciers formed made Illinois farm land fertile and easy to cultivate.

Alluvium, wind-blown sand and loess, peat and muck, and other sediments. A number of different sediments have been deposited on the field trip area since the last glacier melted off the land about 16,000 years ago. With the exception of alluvium, these sediment deposits are too thin or small to show on figure 1, but they are shown and described on the Route Map. Flooding rivers and streams deposit sediment on their floodplains. This material, alluvium, is largely mud. Peat and muck are accumulating in swamps and lakes that fill the by-passed channels and backwaters on the river floodplain.

Winds have blown fine sediments off the floodplain and terraces in the Illinois Valley to form dune and loess deposits. The sand dunes are found on the east side of the Valley on the high-level terrace between Hennepin and Big Sandy Creek. Loess covers the uplands along the valley. As soon as the glacier melted, large quantities of dust blown by winter winds settled on the land. This drift deposit, loess, is as much as 25 feet thick in places along the side of the valley but thins downwind from the valley. The dust was rock "flour," or silt, pulverized by the glaciers. As long as glacial meltwater drained across Illinois, it carried the rock flour into the state's large rivers and deposited it across their wide floodplains. In the winter, when the glacial melting slowed and meltwater flooding abated in the rivers, winds blew the dust off the dry floodplains across the state.

Guide to the route

STARTING POINT—Assemble in the parking lot on the west side of Putnam County High School. The school is on East Silverspoon Avenue on the northeast corner of Granville.

NOTE: To the left of each route direction are two numbers. Both indicate mileages along the field trip route. The upper number tells you how many miles the turning point or landmark mentioned is from the starting point. The lower number in parentheses tells how far it is to the next point described on the route.

__________ Write your car's mileage at the Starting Point on this line. It might help you locate yourself on the route later.

MILES	
0.0 (0.7)	Leave the parking lot and turn right (west) onto Silverspoon Avenue. Go 0.7 mile to the second stop sign (School Street).
0.7 (1.0)	Turn left (south) onto School Street, again immediately stop, and then turn right (west) onto Hennepin Street. Go 1.0 mile west on Hennepin to Milwaukee Street, crossing the Conrail tracks and entering Mark.
1.7 (0.2)	Turn left (south) on Milwaukee Street, which passes on the west side of the red waste rock pile, and go 0.2 mile to Stop 1.
1.9	Park beside the waste rock pile, Stop 1.

STOP 1

The Waste Rock Pile of the Abandoned Longwall Mine at Mark. SW¼ NW¼ NE¼ Sec. 8, T. 32 N., R. 1 W., Putnam County, Spring Valley 7.5-minute Quadrangle.

Mining at Mark. The three waste rock piles and the village of Mark remain to show that coal was mined here for more than 30 years. The construction of the mine, which was called the St. Paul Coal Company No. 1, began when the site was dedicated in June 1903. In August 1904 the air and hoisting shafts were completed, and mining began. In 1905 the annual report of the Illinois Department of Mines and Minerals listed the mine for the first time, reporting that it produced 42,964 tons of coal with a labor force averaging 160 miners and 56 other employees. Three years later, the mine's production was 285,220 tons, and it employed 368 miners and 128 other employees. About 97 percent of the coal mined was shipped by rail to Chicago and other distant markets.

The St. Paul Coal Company operated the mine through 1924, closing it in 1925. In its final year the mine employed 578 men and produced 295,069 tons of coal at the mine.

The mine was reopened in 1930, by a new owner who operated it as the Prairie State Coal Company for nine years, finally closing it for the last time in 1938. Records of the Illinois Department of Mines and Minerals show that during the mine's 29 years of operation it produced a total of 6.9 million tons of coal, an average yield of 240 thousand tons per operating year. During this time, the land around the hoisting shaft, which was located at the northeast side of the largest pile, was undermined a mile to the east and about 3/4 of a mile in the other directions.

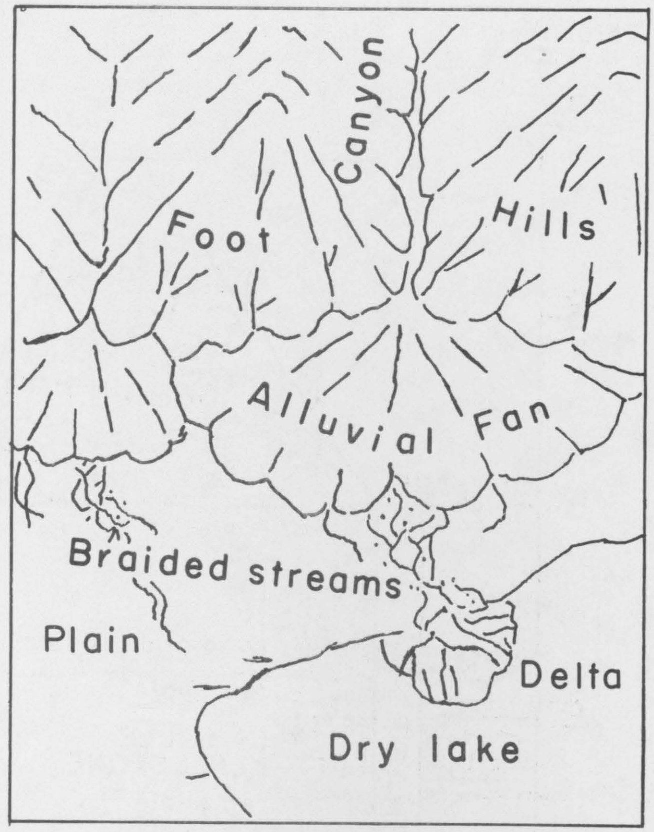
<u>The waste rock pile</u>. As you approach the pile, look closely at the different textures of its sides and the ground beside it. The red and gray pile is as colorful as the South Dakota Badlands and bears other similarities to that terrain. Look at the narrow, V-sided gullies that furrow the pile, dividing and redividing up the slope to form tree-like drainage systems. Rain runs quickly down the sides in sheets and torrential rivulets that wash loose soil and rock downhill. Mass-wasting—slumping and sliding—moves mud and rock down the slopes. Sodden masses of earth after rain slide down of their own weight and form wrinkled humps on the sides and at the base of the pile. The sides of the pile are bare. Because erosion uproots plants before they gain a foothold and because the soil bakes dry too quickly, plants do not grow well here.

Compare figure 3 to the features you see near the base of the pile. Running water which erodes and deposits sediment has formed small-scale landforms that are essentially like the full-sized canyons, foothills, and alluvial fans created by running water in the mountainous dry regions of the West. Running rapidly down steep slopes, streams of water can erode the slopes and carry large volumes of sediment. The same streams, slowing as they run onto flatter slopes of the plains, deposit their sediment loads.

<u>The rocks on the pile</u>. Walking on the pile, examine the different kinds of rocks from the mine that were dumped here. The coal miners dug several inches of underclay out from under the coal so they could break the coal down and out of the seam. Along their haulage ways, they dug out about 4 feet of rock above the 3-foot-thick coal to make a 7-foot-high tunnel that mules pulling the mine cars could walk through. Rock that fell and sagged into the haulage ways had to be removed to keep them open. The waste rock which could not be stowed in the openings left after coal was mined was brought to the surface and dumped on the pile.

Most of the waste rock is soft gray shale, the rock the miners called "soapstone." It is shown in figure 4, the shale above the No. 2 Coal that formed the roof of the mine and was dug down to heighten the haulage ways. Exposed to weather, the book-sized chunks soften, fall into thick plates, and finally turn to mud. Reacting with the sulfuric acid produced

Figure 3. Large-scale landforms modelled by small-scale erosion and deposition features at the base of the waste rock pile.



by oxygen and water which weather the pyrite in the pile, the shale turns red. Burned by the spontaneous combustion of coal scraps in the waste pile, the shale makes hard brick-like chips that clink underfoot.

Less common are the plates of "blistered" black shale. The miners called this rock "slate," perhaps because it is hard and splits into smooth sheets. As figure 4 shows, the black shale generally lies on top of the gray shale above the No. 2 Coal. Sometimes, however, the black shale lay close enough to the coal to be taken down in the haulage ways. Strewn over the slopes are dark gray and brown ironstone nodules—heavy for their size—which were formed in the gray shale above the coal. Of course, there are a few pieces of coal on the pile.

The mine buildings and machinery were torn down and scrapped decades ago. However, a good deal of material washes out of the pile to show that it is a result of human activity: iron tools and bolts, mule shoes, broken bottles, and the sawed-off ends of mine timbers.

<u>The longwall district and longwall mining</u>. From the top of the mine pile one can see the waste piles of 10 other longwall mines, which are identified in figure 5. Visible from here is the northwestern quarter of the Illinois coal mining region called the "Third Vein District." The No. 2 Coal was called the "Third Vein" because in this region it was usually the third coal seam below two others. The Third Vein District includes the southern half of La Salle County and the bordering portions of Bureau and Putnam Counties to the west and Marshall, Woodford, and Livingston Counties to the south. East of the Third Vein District is a smaller one in the eastern half of Grundy County called the Wilmington District. Together, the Wilmington and Third Vein Districts are generally referred to as the Longwall District.

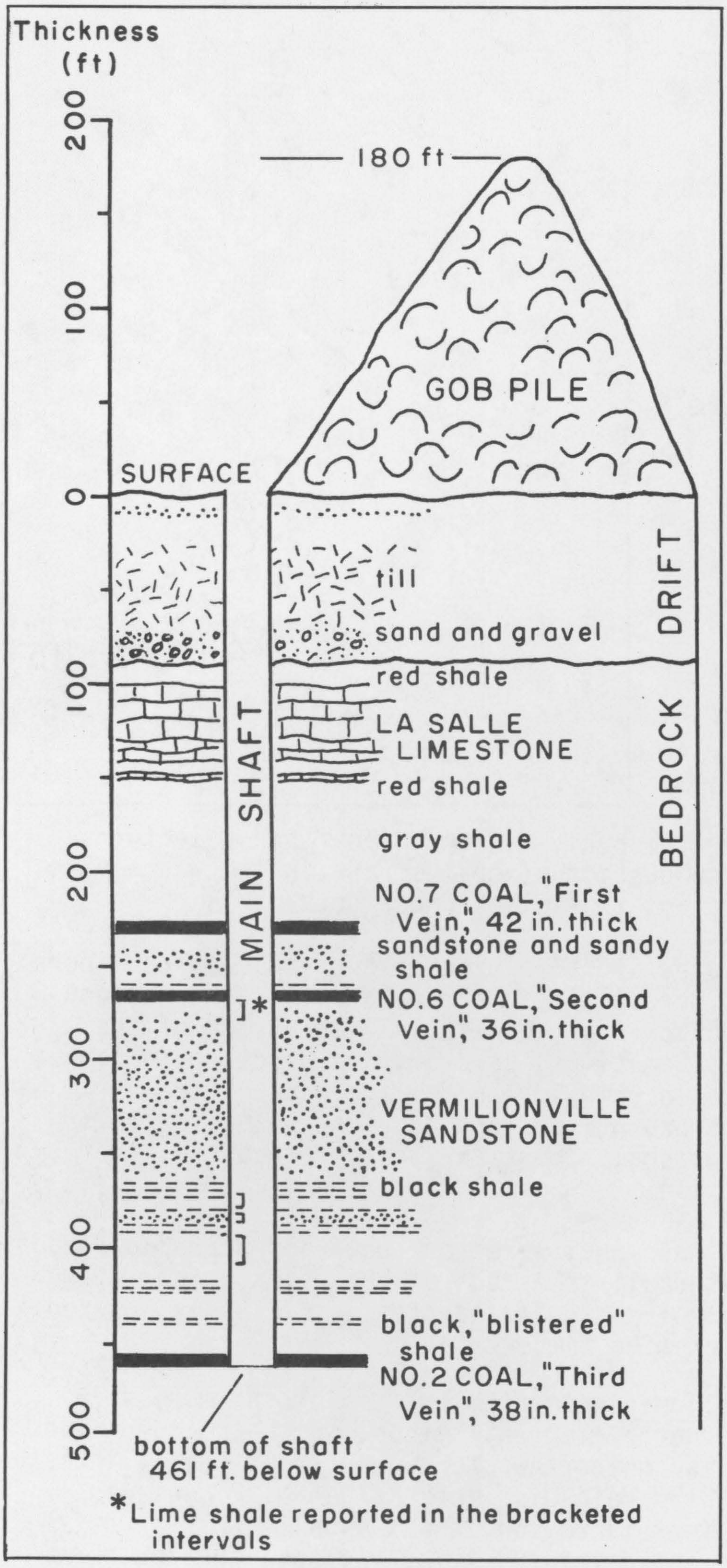


Figure 4. Rock units penetrated by the mine shaft at Mark. Taken from the St. Paul Coal Company shaft log, Illinois State Geological Survey Putnam County No. 17.

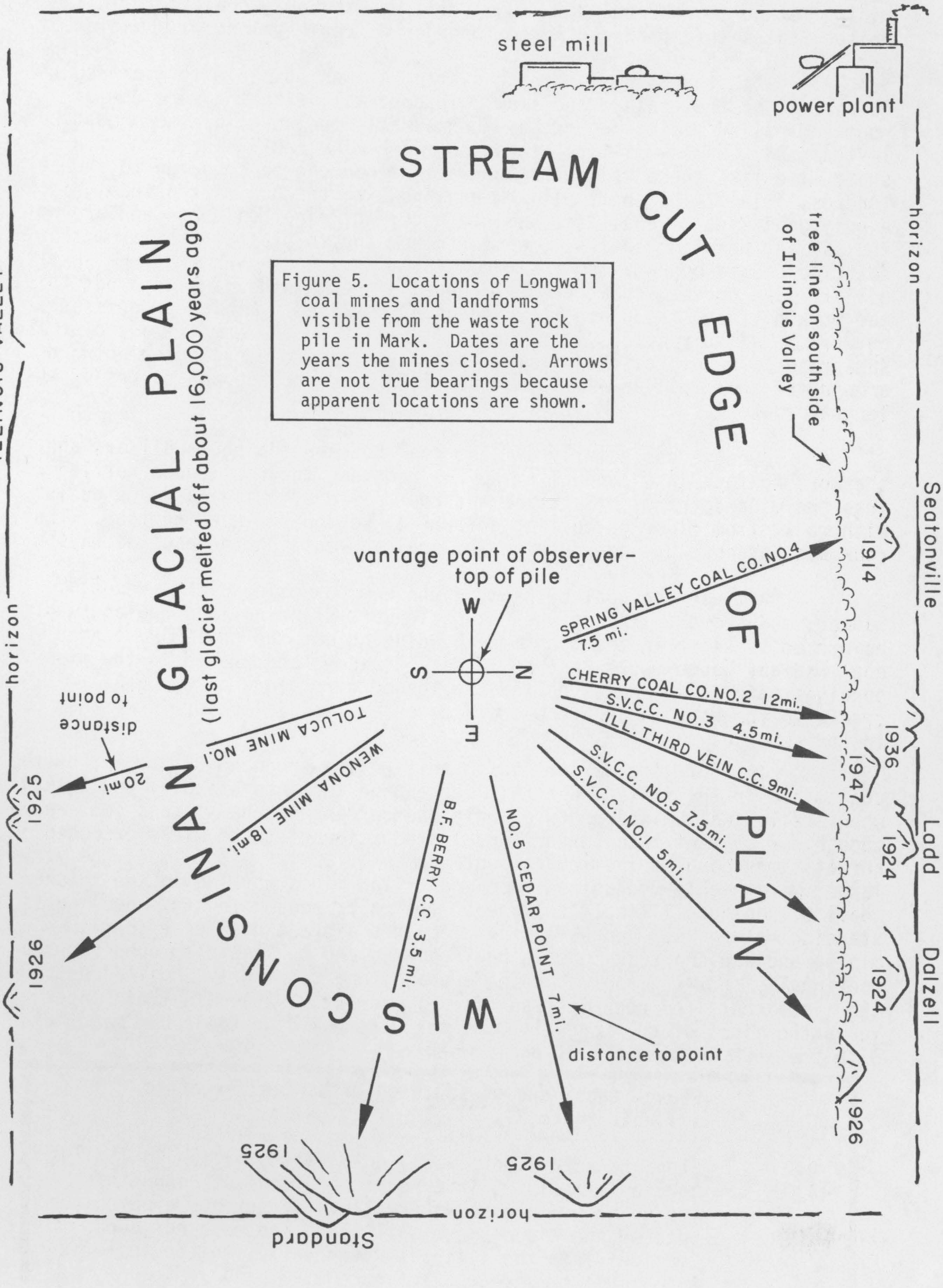


Figure 5. Locations of Longwall coal mines and landforms visible from the waste rock pile in Mark. Dates are the years the mines closed. Arrows are not true bearings because apparent locations are shown.

The Longwall District included all the mines that used the longwall mining method to work the No. 2 Coal. It was the only coal field in the United States that produced large tonnages of coal by long wall mining.

With the longwall mining system, it was possible to mine about 95 percent of the coal in the seam. In contrast, with the more common room-and-pillar mining method, as much as half the coal in a seam must be left as thick walls—pillars—to support the mine roof. The plan of a shaft mine like these using the longwall method can be compared to a wheel (Andros, 1914). The shaft pillar, analogous to the hub of the wheel, is a polygonal area of coal left unmined under the mine buildings and around the air and hoisting shafts to support them and to protect them from the settling caused by removing coal from the mine. Radiating from the shaft pillar—like spokes from the wheel hub—are the main haulage ways out to the working face, the place where the coal is mined. Mining progresses outward in all directions from the shaft pillar at the same time and at the same rate. Therefore, the working face forms a circle expanding outward around the shaft pillar—it forms the rim around the hub and spokes of the longwall "wheel."

Because essentially all the coal between the shaft pillars and the working face in a longwall mine was removed, the roof rocks settled into the mine openings. Settling was controlled by building "pack walls" with rock, from floor to ceiling a few feet behind the working face. The rock was obtained by undercutting the coal and cutting the haulage ways.

A miner dug coal by hand in these mines using pick, wedges, hammer, and shovel. Except when he could work standing in a haulage way, he worked kneeling in the room made by digging out the coal. He loaded coal and any waste rocks that could not be packed and stowed in the mine openings into cars. Mules pulled the loaded cars along narrow gauge tracks to the hoisting shaft where a cage—a simple elevator—drew them to the surface.

In 1882, longwall mines in this region produced 34 percent of the coal mined in the state. But this percentage declined steadily until 1924, when the longwall mines produced only one percent of the state's coal—even though for most of this period annual production of these mines exceeded and at times doubled the 1882 amount (Bement, 1929). After 1906, the very large, more highly mechanized room-and-pillar mines working in the thicker coals of southern Illinois eclipsed. The major reason for this decline is standing before us. Longwall mines required a great deal of effort in mining and hauling rock to make haulage ways and to keep them open under a continually settling roof. On the average, one car in five hoisted out of the mines contained rock instead of coal (Bement, 1929). In their later years the mines of the Longwall District were building their own memorials with the rock hoisted out of their works.

1.9 (0.3)	Leave Stop 1 and go south on Milwaukee Street to Illinois route 71.
2.2 (4.0)	Stop and turn right (west) onto Illinois 71. Go 4 miles to the Illinois 26 intersection outside of Hennepin. The route now crosses the valleys of streams eroding the edge of the Wisconsinan till plain and descends about 200 feet into the Illinois River Valley to the top of a high-level terrace. See figure 6.

6.2 (0.5) Approaching the highway overpass, slow and bear right onto the Hennepin-Lacon Exit Ramp. Stop at the top of the ramp and turn left (south) onto Illinois 26. After the turn, look at the long, low knolls to the right and left. These are sand dunes shown on the route map that were formed when winds from the northwest blew sand across the floodplain and terrace into drifts.

Figure 6 is a geologic section showing the relationships between the different landforms crossed by our route between Stops 1 and 2. Figure 1 and the Route Map show the same features. Together these illustrations make it possible to identify the landscape features we see in the field trip area and to interpret their history.

6.7 (1.0) Cross the Hennepin-Florid Road. Ahead, Route 26 curves right, descends into the valley of Coffee Creek, and runs along the base of the high-level terrace, almost at the level of the Illinois River Floodplain, which can be seen on the right (west).

8.7 (3.3) Illinois 26 curves left and ascends again to the top of the high-level terrace. Here the top of the terrace is nearly covered with sheet deposits and dunes of sand. The low hills rising from the east side of the terrace form the edge of the till plain, deposited by the last glacier to cover the region.

12.0 (2.3) Cross McNabb Road. From here the highway descends to the top of the large alluvial fan at the mouth of Clear Creek Valley.

14.3 (3.1) Cross the Clear Creek highway bridge. Notice the wide valley to the left, the sand-and-gravel-bottomed creek bed, and the broad surface of the alluvial fan to the right of the road.

Clear Creek, like the other streams draining the uplands into the Illinois Valley, drops as much as 100 feet in a mile. In contrast, the Illinois River only falls an inch and sometimes less per mile between Hennepin and Chillicothe. Because of the steep gradients

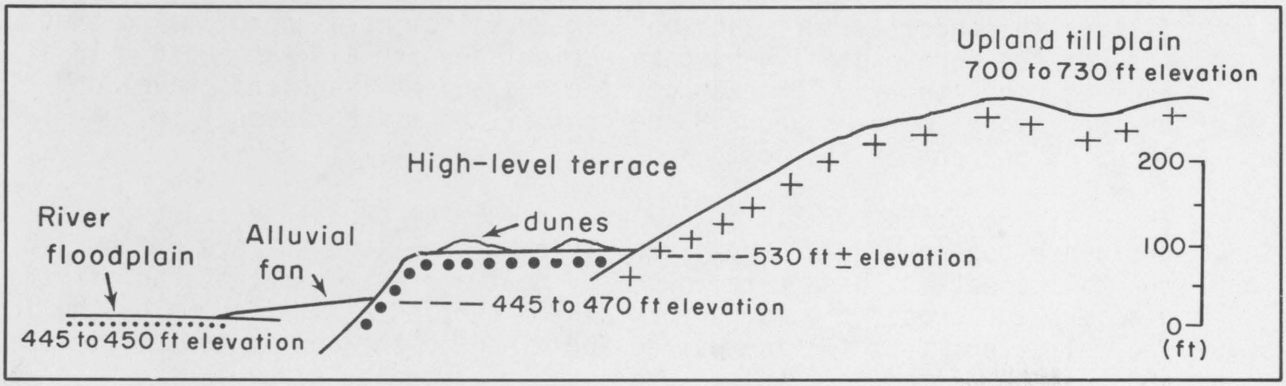


Figure 6. Terrain levels and features crossed between Stop 1 and Stop 2.

(bed slopes) of the creeks, any flooding in these waters is swift and voluminous; as a result the creeks move large amounts of silt, sand, and small gravel onto the Illinois Valley Floodplain. In contrast, the sluggish Illinois River cannot move much of these sediments, so they accumulate at the mouths of the streams in fan-shaped deposits that divert the river's channel to the opposite side of its valley and that partly dam the valley to form its broad, shallow floodplain lakes.

17.4 (0.6)	Stop at the intersection of Illinois 26 and Illinois 18. Turn right (west) and continue 0.6 mile on Illinois 18 and 26 toward Henry. We are crossing the alluvial fan of Sandy Creek.
18.0 (0.3)	At the T-intersection, slow down turn left (south) onto Illinois 26 to Lacon. Prepare to turn left in 0.3 mile.
18.3 (0.5)	Slow down and turn left (east) onto a 2-lane blacktop road. Go 0.5 mile and prepare to turn right just at the curve in the road.
18.8	Turn right and park in the gravel pit, Stop 2.

STOP 2

The Louie Hank Gravel Pit. SW¼ NW¼ SW¼ Sec. 3, T. 30 N., R. 2 W., Marshall County, Henry 7.5-minute Quadrangle.

NOTE: Please obtain permission to visit the pit by contacting the office of Vernon Henry Incorporated, La Rose, Illinois 61541. Phone: 309-399-8401.

Illinois sand and gravel. The Louie Hank gravel pit is worked from time to time to stockpile road gravel, the only product sold from it. Drift sand and gravel deposits like this one provide important supplies of construction material in the midwest. In 1976, Illinois industry produced a total of 38,784,000 tons of sand and gravel with an estimated value of $87,152,000. Evenly divided among our state's 11,229,000 residents (the July 1976 provisional population), this tonnage would provide about 3.5 tons of sand and gravel per person.

Sand and gravel, washed and screened to different product sizes, are used in many ways as surfacing and aggregate materials. Aggregates are the fillers in concrete and "blacktop" mixtures that make up volume so that less of the more expensive binders—cement and asphalt—are used. In an average concrete mix, for example, the aggregates (sand and gravel or crushed stone) make up about 85 percent of the mix but amount to only about 45 percent of its cost.

The drift deposits. In this area and in much of the state, parts of the drift are bodies of sand and gravel lying at the land surface and buried in the till sheets. These were formed by meltwater streams that ran off the glaciers and eroded the muddy rock debris carried and laid down by the ice. The meltwaters from the ice washed and winnowed the sediments they moved and then deposited them—clean and roughly sorted by size—in the water courses they followed.

Sand and gravel bodies are called ice contact deposits if they were laid down in the ice field. They are called outwash plains if they were spread along the glaciers' edges by myriad, small, shifting streams. Valley trains are long, narrow deposits partly filling the valleys of streams that led away from the ice field.

Origins of this gravel. There is ample evidence that the sediments in the pit were deposited by running water. Note that the deposit consists of horizontal layers, which were laid down during different episodes of water flow. Each layer, or bed, is well-sorted: each contains one size of grain. Some beds, for example, consist of sand, while others consist mainly of coarse sand and small-pebble sizes. Since the mud has been washed out, the material is quite clean.

Because this water-laid sand and gravel deposit is close to the Illinois Valley and the elevation of its top (about 520 feet) is on level with the top of the high-level terrace across the river at Henry, it is identified as part of a high-level terrace. The high-level terraces are the remains of a Wisconsinan valley train deposited by meltwater in the time between about 16,000 years ago (after the glacier melted out of the Middle Illinois Valley) and about 14,500 years ago (before the Kankakee Flood). As the last glacier melted back eastward from the Middle Illinois Valley, its meltwaters drained down the existing valley and filled it about half full of sand and gravel—the sand and gravel deposit, or valley train, labelled Henry Formation on the Route Map and figure 1.

The high-level terraces were formed in the valley train about 14,500 years ago by a high meltwater flow called the Kankakee Flood. The Kankakee Flood eroded a wide channel into the valley train, leaving parts of it in step-like deposits—terraces—along the sides of the Middle Illinois Valley.

The Kankakee Flood. The Kankakee Flood occurred about 14,500 years ago. When the glaciers covering northeastern Illinois and the Middle Illinois Valley had melted back until their fronts were north, northeast, and east of the present Kankakee Valley in Illinois and Indiana. Then an interval of rapid melting concentrated great volumes of meltwater in the Kankakee Valley area from the ice front. The meltwaters flowed westward, but the belts of moraines between the Ottawa region and the ice front prevented their draining away to the south and west. As a result, the impounded meltwaters rose higher and higher, forming broad lakes in what are now the Kankakee River watershed in Indiana and Illinois and the watersheds of the Vermillion, Macon, and Iroquois Rivers in Illinois.

Finally, the rising meltwaters overtopped the moraine between Seneca and Ottawa and rapidly cut a gap that released the Kankakee Flood into the Illinois River Valley.

Collecting rocks here. As the glaciers flowed southward into Illinois from Central Canada, they picked up rocks from every region they crossed. Consequently, gravel pits in the northeastern quarter of Illinois, being drift deposits, are excellent places to collect rocks, minerals, and fossils. Only the soft and easily split rocks from distant regions are missing. These weak sedimentary and metamorphic rocks—shales, slates, mica schists, etc.—were pulverized by the flowing ice. The weak sedimentary rocks we do find here—the shales and coal, for example—are local rocks that the ice and meltwater did not move far.

18.8 (0.5)	Leave Stop 2. CAUTION: As you leave the pit, watch the blind curve to your right. Turn left (west) onto the road and return to Illinois 26.
19.3 (0.3)	Stop at the intersection of Illinois 26 and the blacktop road. Turn right (north) onto 26.
19.6 (0.9)	Stop at the intersection of Illinois 18 and 26. Turn left (west) onto Illinois 18 to Henry. For the next 0.8 mile we cross Sandy Creek's alluvial fan, which has diverted the Illinois River into a narrow channel against the terraces on the west side of the valley.
20.5 (0.15)	Crossing the bridge over the Illinois River, prepare to turn left (southwest) on Front, the first left turn after leaving the bridge.
	Look down to the right to the Henry side of the river and note the stone walls of the old lock and dam. This is the view shown on the cover of this guide leaflet.
20.65 (0.15)	Turn left on Front Street. Go one block, stop, and turn left (southeast) on Edward Street. Go to the bottom of the hill on Edward and turn right into Henry Park.
20.8	Stop 3 and lunch. The flat area of the park at the base of the hill is the north end of a low-level terrace that extends downstream about 5 miles. The top surface of the low-level terrace is 20 to 30 feet above the river; its high elevations are slightly more than 470 feet above mean sea level. Henry is built on the top of the high-level terrace at elevations generally between 490 and 500 feet above sea level.

STOP 3 **Lunch at the riverfront park and old dam site in Henry. SW¼ NE¼ SE¼ Sec. 16, T. 13 N., R. 10 E., Marshall County, Henry 7.5-minute Quadrangle.**

Water resources. In the field trip area, water supplies are obtained from the Illinois River, from the sand and gravel deposits in the glacial drift, and from bedrock. Peoria, for instance, obtains water from the Illinois River. A relatively few homes and smalltowns on the uplands pump water from wells in bedrock. Ground water supplies are easy to find in the Valley, and most of the communities, industries, and private homes and farms get their water from wells in the glacial drift (Selkregg and Kempton, 1958). The Sankoty Sand is the major aquifer in the valley. It yields large ground-water supplies for communitites and industries. The terrace and alluvial fan deposits yield moderate amounts of ground water. Henry pumps water from the Sankoty Sand and the terrace deposits.

On the uplands only a few miles from the river, locating a source of water if often a problem. The Wisconsinan tills contain thin lenses of sand, sandy clay, and silt, which may yield water to wells, though only in small amounts. Many farmers on the upland west of the river have difficulty obtaining sufficient water. Thus they often use a large diameter well and some type of water storage facility to maintain an adequate supply.

The Pennsylvanian bedrock underlying the field trip area is largely mudstone and shale. It is not considered to be a significant source of ground water in this area; however, where obtaining a supply from the drift is difficult, the bedrock is often tested. Sometimes the shale at the bedrock surface contains sufficient water-filled fractures to yield water. Except in the far northern and western parts of the region, the ground water in the bedrock formations below the Pennsylvanian rocks is highly mineralized. In general, water from bedrock below a depth of about 100 feet may be too salty and mineral-laden to use.

Geologic History of the Illinois River. The development of the present Illinois River Valley began during the long period of erosion following the Paleozoic Era (Willman, 1973). A system of rivers and streams developed on the pre-glacial land surface. Valleys became deeply entrenched into the bedrock; whether this entrenchment occurred prior to glaciation or during the early stages of glaciation is unknown. One of the rivers, the Ancient Mississippi, flowed southeast from northwestern Illinois and then south from Hennepin, essentially following the course of the present Illinois River from Hennepin to Calhoun County (figure 7). Large volumes of melt water flowed through this valley during the early stages of glaciation and deposited the thick Sankoty Sand. Later glaciations covered the bedrock and the sand-filled valleys with drift.

These sand-filled valleys are frequently referred to as "underground rivers." This term is misleading. The water in them is not flowing in a large cave. It is seeping through the tiny spaces between grains of sand and gravel. In the thick deposits of sand buried in these valleys are large volumes of water flowing very slowly at velocities 1½ to 5 feet per day. This ground water is rainfall that has slowly percolated down through the overlying drift into the sand deposits. Water wells ending in these sands will usually yield large ground-water supplies.

Illinoian glaciers overrode the ancient Mississippi valley at least three times (Willman and Frye, 1970), diverting the river to the west each time. During the Sangamonian Stage, the interglacial stage between the Illinoian and Wisconsinan glaciations, the Ancient Mississippi again flowed through central Illinois. During the Woodfordian glacial advance, the Mississippi was again diverted to the west where it remained. This event has been dated about 21,000 years ago (Glass et al., 1964). Late in the Wisconsinan glaciation the Kankakee Flood widened the Middle Illinois Valley to essentially its present configuration. When ice had retreated from the midwest, the drainage in the Illinois River was reduced to its present level so that a small river was flowing in a valley cut by much heavier flows of meltwater.

Along the Illinois River below Hennepin, the slope of the valley floor is extremely low. This low slope was established by the Ancient Mississippi. Generally, a river the size of the present Illinois River would be expected to have a steeper slope (Barrows, 1910). Because of this

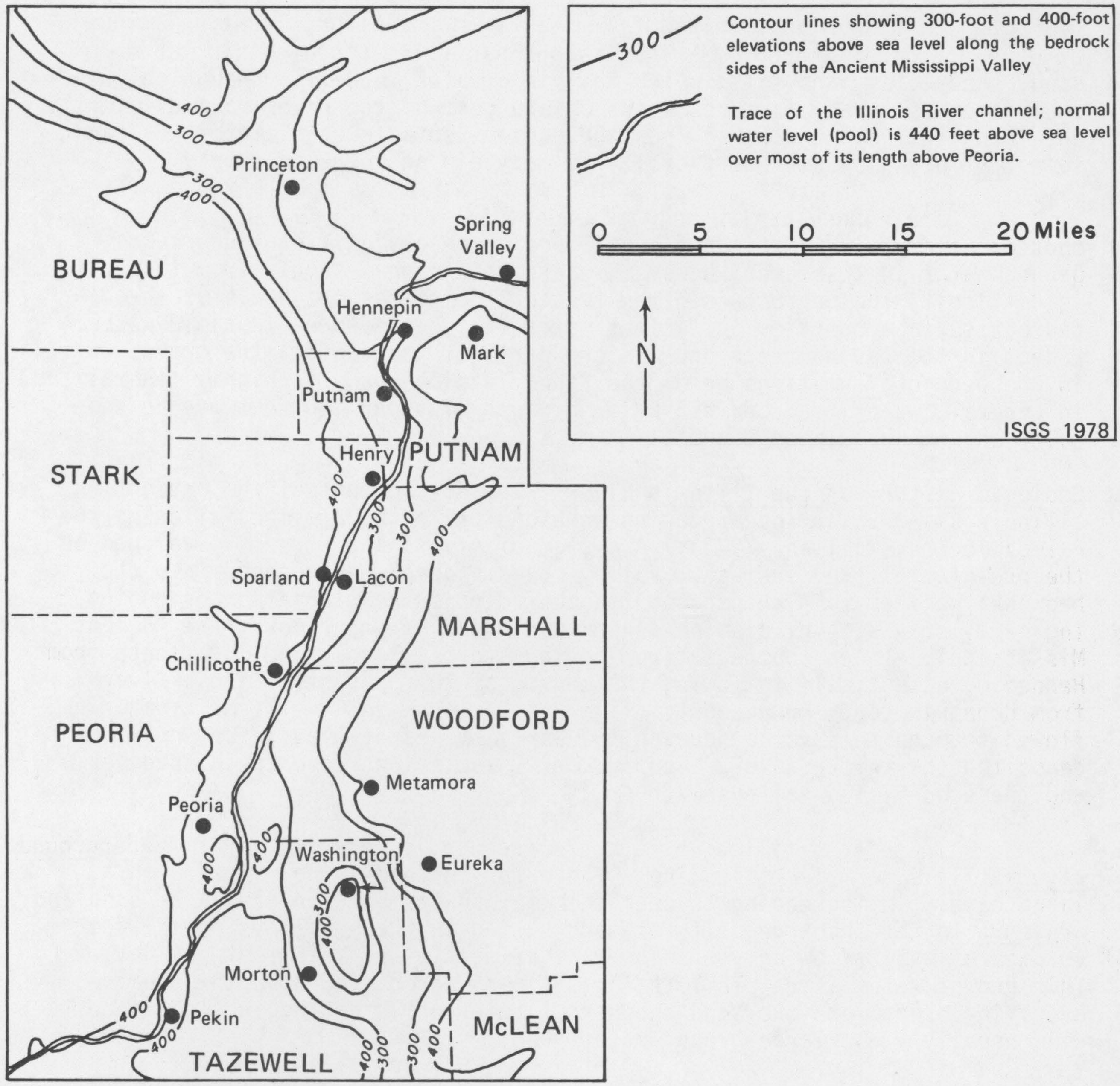


Figure 7. The trace of the Illinois River in the field trip area drawn over the contour outline of the buried Ancient Mississippi Valley. The Ancient Mississippi River cut its valley into bedrock, and so the countour lines follow the bedrock surface, which is as much as 150 feet below the pool of the Illinois River. Even though buried by glacial drift, the Ancient Mississippi Valley caused a depression on the drift surface that helped direct later glacial metlwaters which cut the present day valley nearly parallel to the course of the older one between Hennepin and Peoria.

low slope, the river water does not have sufficient velocity during normal flow to move sediment carried into the river by tributary streams. Thus, large alluvial fans are accumulating at the mouth of these streams. The alluvial fan at the mouth of Sandy Creek, for example, is shown on the Route Map. These alluvial fans act as dams, creating behind them the lakes found along the Middle Illinois River. Since the river cannot pick up and transport the sediment in the alluvial fans, it has to flow around them, creating its tortuous path.

Harlan H. Barrows, author of the Geography of the Middle Illinois Valley, explained the relationship of town locations in the valley to the location of large alluvial fans and the high-level terraces.

> Every important town of this part of the valley grew up upon a terrace, avoiding alike the bottoms that are subject to floods, and the uplands that are usually 150 feet or more above the waterway. The early relations of the villages to the river are reflected in the fact that the streets in the older quarters run parallel to the river front and at right angles to it, rather than with the points of the compass. The immediate location upon the terrace edge was in several cases determined by relatively large tributary streams on the opposite side of the valley, whose deposits crowded the river to the terrace side of its flood-plain. Pekin and Peoria appear to be striking illustrations of this control. Peoria has spread from its lower terraces to an upper one, and is now spreading back upon the upland.

The lock and Dam at Henry. Today, the Illinois River and Lake Michigan are connected through the Chicago Sanitary and Ship Canal and the Calumet Sag Channel. Until the mid-nineteenth century, the Illinois River was a clear and very shallow river with its headwaters a few miles west of Lake Michigan near Chicago. As early as 1673, Joliet and Marquette noted the feasibility of connecting the two bodies of water with a canal, and the need for such a canal was realized early in the development of Illinois. The first canal, completed in 1848, ran from Lake Michigan to La Salle, making the Illinois River an important route for commerce and settlement.

The shallow depths of the Illinois River still hampered up-river traffic north of Peoria and, as the size of the boats increased, this problem became severe. In 1868, a program of canals along the lower Illinois River was proposed. In 1872, the first lock and dam in the program was constructed at Henry. In this project, the river bed between Henry and La Salle was dredged to deepen the channel. Later, locks and dams were built and further dredging carried out at other sites along the river.

In 1900, a bond issue passed by state referendum, included money for construction on the Illinois River. New locks and dams were built on the river to replace the old ones. As a result, the dam at Henry was dismantled in 1928. In 1939, part of the lock was removed. Today all that remains are parts of the two lock walls.

20.8 (0.2)	Leave Stop 3. Go southward along the river front street and turn right on Main Street. Go 2 blocks to Second Street at the town square of Henry.
21.0 (0.2)	Stop and turn left on Second Street, then go right at the next corner onto Park Row. Go one block on Park Row to Third Street.
21.2 (0.7)	Turn left (southwest) on Third Street (Illinois 18) and follow Third Street 0.7 mile to the intersection of Illinois 18 and 29.
21.9 (1.8)	Turn left (south) on Illinois 29. For the next two miles, we travel over the flat surface of the high-level terrace.
23.7 (2.0)	The "step" in the road descends about 20 feet to the low-level terrace.
25.7 (1.5)	Cross the highway bridge over Crow Creek. Note that the road is approaching the bluff line, the west wall of the Illinois Valley, which is composed of till overlying Pennsylvanian bedrock. In a seven-mile-long region centered on Sparland, the Danville (no. 7) Coal has been mined in many places in the creek valleys cutting the bluffs and in the bluff sides. Look for the gob piles that mark the abandoned mines—piles of black shale on the hillsides beside the road.
27.2 (0.5)	In the next 0.2 mile see long outcrops of sandstone and a mine gob pile on the right (west) side of the road.
27.7 (0.9)	On the right, note several outcrops of Pennsylvanian limestone, which contain fossils.
28.6 (1.2)	Enter Sparland slowly and watch for the Illinois 17 intersection. Turn sharply to the right (west) at the intersection and ascend the hill. Follow Illinois 17 for 1.8 miles to the turn.

CAUTION: There is a 5-ton-limit, one-lane bridge on this part of the route at mileage 33.5.

The route circuit made west of Sparland (mileage 28.6 to mileage 33.7) takes us along the Gimlet Creek Valley within sight of a number of the Pennsylvanian rock units uncovered by Gimlet Creek as it flows from the upland down to the Illinois Valley. Figure 8 describes the units at the upper end of the valley: the Lonsdale Limestone, which we see, at mileage 31.1 and again at the Princeville Quarry (Stop 6), and the units below it down to the Farmington Shale, which lies above the No. 7 Coal.

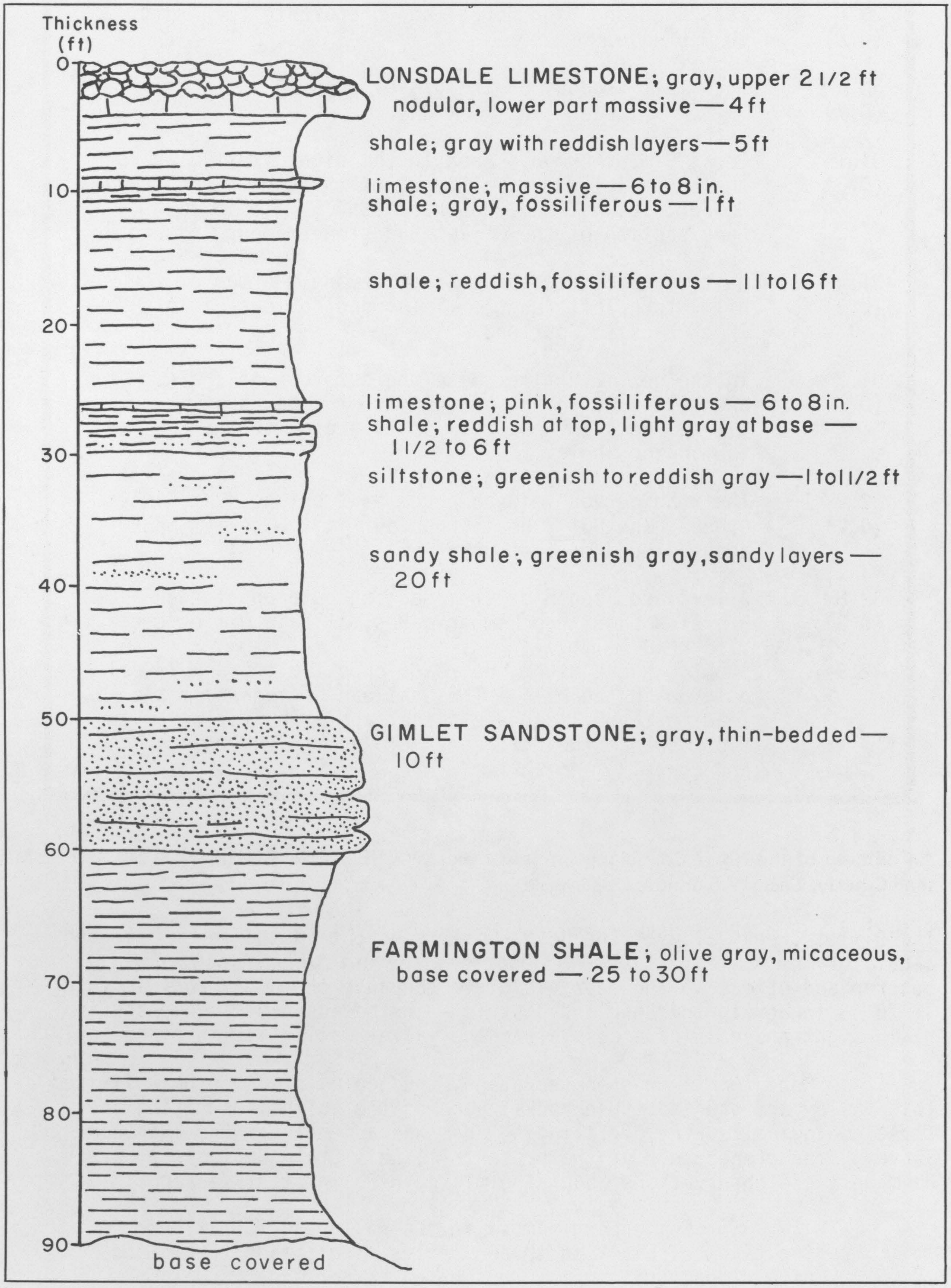


Figure 8. Rock units exposed in Upper Gimlet Creek Valley, adapted from H. R. Wanless field note 0715.51, Sec. 15, T. 12 N., R. 9 E., Marshall County.

29.8 (0.6)	Pass Sparland High School and prepare to turn left in 0.6 mile.
30.4 (0.7)	Turn left (south) on the gravel road.
31.1 (0.3)	Cross Gimlet Creek. Look to the right (west), where the creek falls over a ledge, of the Lonsdale Limestone Member. Downstream, to the east 0.5 mile, is the type section of the Gimlet Sandstone Member, figure 8.
31.4 (0.3)	At the road intersection just beyond the top of the hill, turn left (east). This road follows Gimlet Creek back to Sparland.
31.7 (0.7)	In the next 0.5 mile, note the outcrops of shale and siltstone in the ditches and the banks of Gimlet Creek. These rock units are named the Farmington Shale.
32.4 (0.2)	The road curves left and crosses a bridge over Gimlet Creek. The No. 7 Coal crops out in the stream bank about a hundred feet upstream.
32.6 (0.3)	A few yards south of the road, an outcrop of the Brereton Limestone Member makes falls in Gimlet Creek.
32.9	Stop 4. Park along the road, opposite the No. 7 Coal outcrop in the hill. The coal can be seen from the road in the hill about 30 feet above the valley floor, where the hill comes closest to the road and creek.

STOP 4

An outcrop of the No. 7 Coal along Gimlet Creek. SW¼ SE¼ NE¼ Sec. 15, T. 12 N., R. 9 E., Marshall County, Lacon 7.5-minute Quadrangle.

The Gimlet Creek Valley. The No. 7 Coal crops out in the lower mile-and-a-half of the valley. Figure 9 describes the units that show in this outcrop and others in the near vicinity. Because the No. 7 Coal is thick—42 to 48 inches in the Sparland District—and because it was exposed in plain sight and easy of access along the valley walls, it was mined early.

More than a hundred years ago, the geologist James Shaw visited this valley and studied these rocks. One of the scientists making the first geological survey of Illinois, Shaw was a member of the "Worthen Survey," the predecessor of the present Illinois State Geological Survey. He made these observations about the mining here in his 1873 report:

> Commencing almost in the village [of Sparland], the piles of black earth and shales, indicating the mouths of old coal drifts, may be seen on either side, and some forty feet above the level of the water in the brook. For about two miles up the hollow, these old drifts mark a regular black line along the face of the hills. Most of

them are not now worked. Some have been abandoned for years. None of them have been worked with any great energy or capital; but the aggregate amount of coal taken from them in past years has been immense. The drifts extend back into the hills from fifty to two hundred yards. The style of mining has been and now is very primitive.

Apparently, all the mines in the No. 7 Coal in the Sparland region have been drift mines using room-and-pillar methods. A drift mine enters a coal seam at its outcrop and follows the seam underground.

The Sparland Coal Boom. The highly visible coal outcrops around Sparland fostered a boom in the late 1860s. According to Maud E. Uschold, a local historian, at least three companies obtained major holdings near Sparland in Steuben Township to mine coal. The Chicago and St. Louis Coke and Coal Company established local operations in 1864. Among other properties, the company held 220 acres in Section 23, about a mile south of Sparland in the vicinity of Stop 5. The company sought to mine the No. 7 Coal and coke

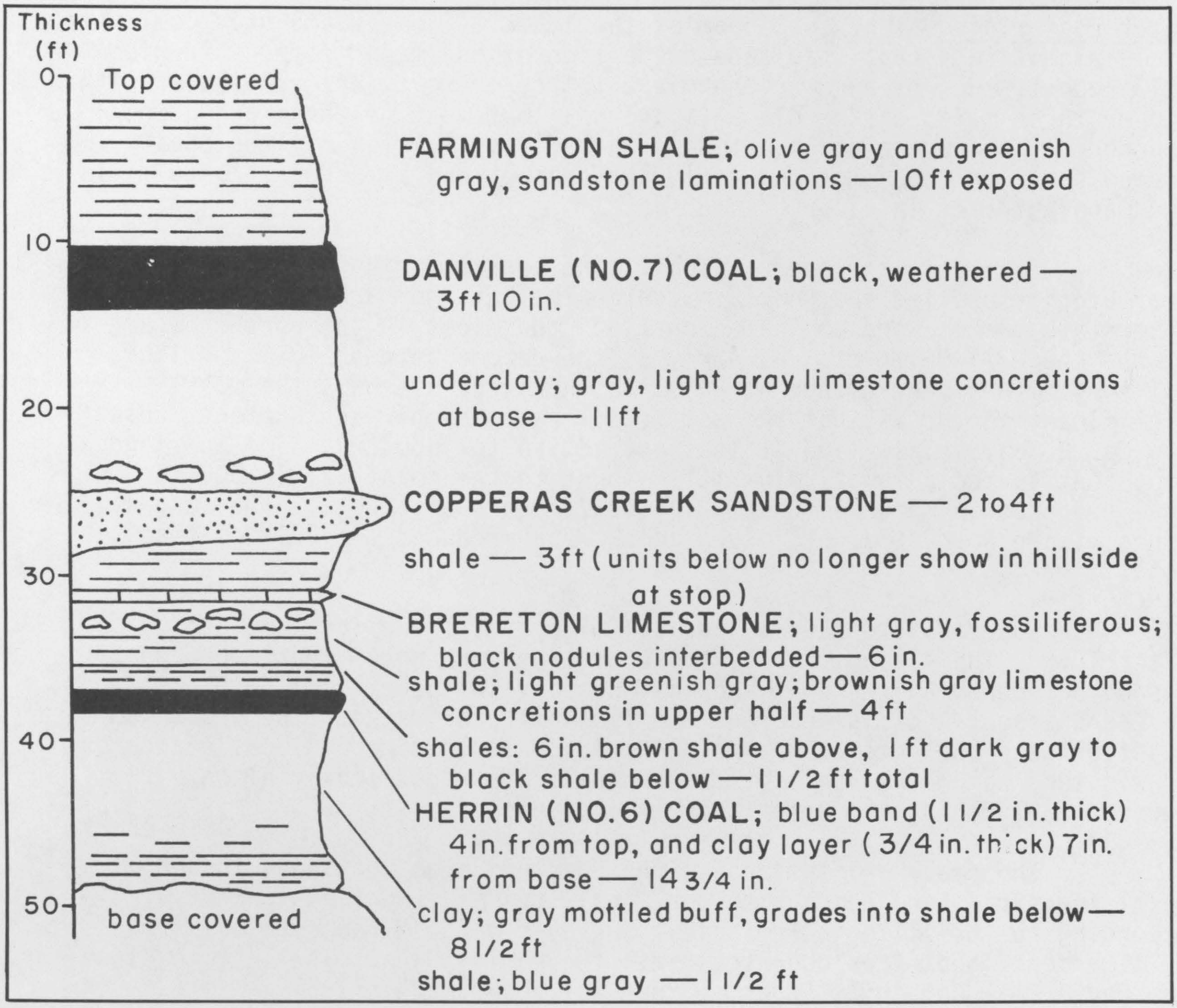


Figure 9. Rock units exposed in Lower Gimlet Creek Valley, adapted from H. R. Wanless field note 0715.7½5, Sec. 15, T. 12 N., R. 9 E., Marshall County.

it in earth ovens, but its efforts were not commercially successful. Holdings of the Chicago and St. Louis Company were used to form a new organization, The Sparland Lime and Mineral Manufacturing Company. The Sparland Lime and Mineral Manufacturing Company built and operated a lime kiln and experimented with the production of clay products and Prussian blue dye.

A second company, the Chicago and Bureau Valley Coal Company, was organized in 1865 to mine in 185 acres in Sections 26 and 34, south and southwest of Stop 5. The company shipped coal to Chicago and built a company "town" of about 15 houses south of Cooper Run (perhaps the creek valley in the bluffs at mileage 35.7 where the Hydraulic Press Brick Company later built houses for employees). The settlement, called "Grantville," was in ruins by 1880.

The third company, the Steuben Coal Company, began mining several years after the others in Section 2, a mile or so north of Sparland. In 1890 when the company offered its property for sale, it owned 170 acres of coal land here.

Later coal mining. The coal boom of the 1860s evidently amounted to little. It is significant that Shaw made no mention of any major company in his 1873 report. He observed: "There are thirty or forty drifts in all, within two or three miles of the place (Sparland), but most of these are now abandoned. A few are still actively worked, and furnish all the coal needed for local consumption, including that burned by several large mills and manufactories in Lacon."

Sparland was never a significant coal shipping district. Mines near Peoria supplied the Peoria market. The Chicago market and the northern interstate market were dominated early by the mines in the northern part of the Longwall District. As early as the decade between 1856 and 1866, six shaft mines were opened at La Salle, upriver. Perhaps the most significant factor is that the No. 7 Coal has a higher ash content than the No. 2 Coal. This made it less attractive to industry. The Sparland area contributed a relatively small amount to the total 12,516,000 tons of coal produced in Marshall County in the 70 years of record. The longwall mines mining No. 2 Coal at Toluca and Wenona produced the bulk of that total.

Sparland did have a longwall mine of its own for some period after 1889. The Illinois Coal Report of that year notes that a new shaft was being opened by the Sparland Coal Company in the village just east of the Chicago, Rock Island, and Pacific Railroad tracks. The shaft was 164 feet deep and entered the No. 2 Coal. A large mine by local standards, it was much below the scale of the Longwall District, employing only 27 persons in 1901 and producing only 11,615 tons of coal.

The small drift mines in the Sparland area continued to supply local industries and homes with coal until the mid-twentieth century. According to the Illinois Geological Survey's map, "Mined-out Coal Area 7," 18 identified mines operated until the early 1940s. The last to close—the Davis Coal Company's Fogarty Mine—was abandoned in 1951.

32.9 (0.8) Leave Stop 4. Follow the road 0.8 mile east to its intersection with Illinois 29 in Sparland.

33.7 (1.3) Stop and turn right (south) onto Illinois 29. Go 1.3 miles to the entrance of the Marshall County State Conservation Area, Stop 5.

35.0 Slow and turn left into the Marshall County State Conservation Area. Park in the lots south of the large shelter.

Valley slopes along the bluffs of the Illinois River Valley in this region are generally unstable and mass movements are common (Hunt, 1974). These mass movements are a kind of landslide, but the actual ground movement is not so rapid and usually involves the slow creep of land downslope. Mass movement can occur for several reasons, most notably in this region because of local over-steepening and erosion of the bluff sides or excessive seepage from them, or both together.

Areas where mass movement has occurred can be detected by observing the structures and vegetation. Often trees, poles and fence rows are leaning downslope. Structures may show cracking, and in extreme cases they may also lean. Drainage ditches are squeezed shut as soil moves downslope. Roads become bumpy as the land slowly shifts under them. The bumpy character of Route 29 between Sparland and Chillicothe is probably due to this phenomenon.

STOP 5

The site of the Hydraulic Press Brick Company plant in the Marshall County State Conservation Area. NW¼ SE¼ SW¼ Sec. 23, T. 12 N., R. 9 E., Marshall County, Lacon 7.5-minute Quadrangle.

History of the site. Little but the brick underfoot everywhere remains to show that a brick plant operated here for over 50 years from 1916 to 1969. East of the highway a round-roofed brick-storage shed still stands, preserved as a shelter. South of the shelter about 150 yards, one sees the top of the plugged main shaft that once descended 250 feet from the surface into the clay mine. A concrete pier lying on the west side of the highway was part of the bridge and narrow gauge track that carried carloads of shale over the highway. Most of the plant has been destroyed by the company's salvaging, the relocation of Route 29 to the west, and development of the site by the Conservation Department.

The brick plant was built by the Lacon Clay and Coal Company, which operated it from 1916 until 1923. The Lacon Company built eleven kilns (which the industry pronounced "kills") and mined the Farmington Shale in the bluffs to make red brick. A shale pit can still be seen in the hillside across the highway, due west of the mine shaft. About 40 feet of dark gray shale are exposed under 51 feet of till. According to Mr. A. J. Osborne (1978), a Superintendent at the Hydraulic Press Brick Company Plant, the Lacon Company opened at least three pits and used high pressure water jets—hydraulic mining—to strip the till off the shale.

The Lacon Company sold the plant to the Hydraulic Press Brick Company of St. Louis in 1923. This large company operated 25 plants in the midwest in the 1930s, including seven in the St. Louis area. Soon after purchasing this plant, Hydraulic Press Brick sank a shaft down to a thick claystone bed about 20 feet below the No. 2 Coal. (This is the interval including the Hermon and De Long Members of the Spoon Formation.) After 1924, the mine provided most of the clay used by the plant.

The claystone bed was 6 to 8 feet thick in the first areas mined near the shaft and as much as 20 feet thick in an area farther southwest which was mined in the 1950s. The claystone burned buff, a light color that made it possible to mix and treat the clay in a number of ways to produce different brick colors. It made a hard, high-quality face brick.

The Hydraulic Press Brick Company finally closed its plant in May 1949 after 41 years of operation. Shortly after, the property was sold to the state and made into a conservation area.

The Plant Operations. During the 41 year history of the Hydraulic Press Brick Company, it engaged in a complete range of brick-making operations including mining on site the shale and clay from which the bricks were made, processing the shale and clay into mud, and making and burning the bricks.

Mining—Under the plant area and as much as half a mile beyond are about 40 miles of mine tunnels excavated as the claystone was dynamited from its bed. The wood-propped mine tunnels were about 8 feet high and 9 feet wide in the thinner part of the bed and about 10 feet by 12 feet in the thicker. Intersecting lines of entries were dug about 60 feet apart and solid claystone pillars 60 feet on a side were left to support the roof. Less than 20 percent of the clay deposit was mined.

The dynamited claystone was loaded onto narrow gauge mine cars and hauled to the hoisting shaft—in earlier years by mules, later by electric cars. Mr. Osborne notes that the mine had an exceptional safety record: from 1924 to 1965 only two men were injured and no one was killed. The dark gray, red-burning shale was dug from the surface pit in the bluff and blended with the buff-burning clay to make certain colors of brick. Mine cars hauled shale from the pits across the bridge over the highway to the plant.

Mud Processing—The plant used the "stiff mud process" to make brick. First, the claystone and shale were crushed to powder and blended in the proportions needed to make the different colors of brick. Next, the dry, blended clay was conveyed to the motor-driven pug mill, a machine resembling a cement mixer, in which it was mixed with just enough water to make a uniform "stiff mud" that would form smoothly and hold its shape. The pug mill augered the mud out through a rectangular die opening, extruding a continuous beam of clay. Core bars inside the pug mill and just behind the die formed holes running the length of the beam.

As the beam was conveyed away from the pug mill, a combination of blades, wires, or rollers cut and impressed one of a number of different textures on the three exposed sides of the beam. Next, moving wires sliced across the beam to cut it into bricks. The applied textures appear on the "headers" (the two ends of the brick)—and on the "face" (the long narrow side that was the top of the beam). The moist "green" bricks were stacked on small rail cars and rolled into heated tunnels to dry.

Brick Burning—The green brick were dried and then rolled into an empty kiln and stacked by hand into a single large pile. The kilns, resembling brick igloos with chimneys, were 32 feet in diameter and 18 feet high. They were the periodic downdraft type—called periodic because they were not fired continuously. Various reports indicate that the kilns held from 70 to 90 thousand bricks.

After the bricks were stacked, the entrance to the kiln was cemented shut, and the fireboxes around its wall were lighted. Coal was the fuel, but apparently, local No. 7 Coal was not used. The bricks were burned for seven or eight days, the ordinary firing temperatures being held between 1920° and 1980°F. When the burn was finished, the kiln was allowed to cool and then was emptied and loaded again for another burn. The plant capacity was about one million bricks per month.

The Bricks. Closely examine the bricks piled along the shore. Several sources credit this plant with producing more than 50 different kinds of brick in its later years. The combinations of different sizes, colors, and applied textures could account for at least this many.

The two sizes were "regular" and "Norman." Norman was a brick-and-a-half size. Five basic colors were produced. Buff was the natural fired color of the claystone. Reds were made by blending large quantities of the red-burning shale with the buff-burning clay; salmon tints—pinks—by using smaller amounts of shale. Grays were produced by dusting the green bricks with manganese dust. Tans and browns were created by smoking the bricks at the end of the burn—coal dust was thrown on the fires.

At least six textures can be found in the bricks remaining on the site. (An applied texture appears only on the headers and face of a brick. Marks on other surfaces are made by the pug mill die, cutters, and other handling devices.) "Basic smooth" is the texture made by the die alone. "Sanded" is made by sprinkling sand on the surface of the damp brick beam and pressing it down with a roller. "Weatherproof" is a rolled-on, dimpled texture that improves the water-shedding and light-reflecting characteristics of the brick. "Cameo" and "Oak Bark" are rough textures made by cutting ribbons of clay up from the brick beam and then rolling the ribbons back down on the surface again. Cameo is formed by parallel, 3/16-inch-wide ribbons of clay laid perpendicular to the long side of the face. The Oak Bark texture is made with much wider and irregular, overlapping ribbons that run parallel to the long side of the face.

35.0 (3.6)	Leave Stop 5 and turn left (south) onto Route 29. Follow 29 for 6.6 miles to the Princeville Road intersection in Chillicothe.
38.6 (2.0)	The rest area on the left is on the north end of the very large high-level terrace on which Chillicothe is built.
40.6 (0.4)	Cross the bridge over Senachwine Creek. Note on the right (west) the large Martin Marietta gravel pits which are developed in the gravels of the high-level terrace.

41.0 (0.7)	Enter the railroad underpass. Watch for the right turn ahead about 0.6 mile on the curve in the highway.
41.7 (0.3)	Turn right (west) onto Princeville Road (Truitt Street) and follow the road west for about 12 miles.
42.0 (0.5)	Four-way stop at Santa Fe Avenue. Continue ahead west.
42.5 (2.3)	Leaving Chillicothe, look across the high-level terrace surface to the hills—the edge of the till plain—at the west side of the Illinois Valley.
44.8 (3.6)	Y-intersection near the base of the hills. Continue straight ahead. In the next 4 miles the road ascends the west side of the valley, which has been deeply eroded by closely parallel streams draining down from the crest of the Providence Moraine ahead to the Illinois River Valley.
48.4 (1.0)	Cross the Centerville Road. 0.7 mile ahead is the crest of the Providence Moraine. The intersection with Illinois 88 is just beyond it.
49.4 (1.3)	Stop at the Illinois 88 intersection. Then continue ahead (west) on the Princeville Road, Illinois 90.
50.7 (1.2)	Cross the Chicago and Northwestern Railroad tracks. The high ground rising ahead of us is the Buda Moraine.
	Follow 90 to the left and prepare to turn right.
51.9 (0.4)	Stop at the intersection of Illinois 90 and 91. Turn right (west) onto 90-91. Bear right under the railroad overpass and then left beyond it.
52.3 (1.7)	Crossing the wide crest of the Buda Moraine. Beyond the crest to the west is the Illinoian glacial plain.
54.0 (1.7)	Slow and turn right (north) onto County Highway 51.
55.7	Turn left (west) into the Long Rock Quarry. Stop at the office and ask permission to enter the quarry.

STOP 6 **The Long Rock Quarry near Princeville. NE¼ NE¼ Sec. 8, T. 11 N., R. 7 E., Peoria County, Dunlap 15-minute Quadrangle.**

NOTE: Please obtain permission to visit the quarry by contacting the office of the Long Rock Company, Princeville, Illinois 61559. Phone: 309-385-4516.

The Long Rock Quarry. It is likely that the Lonsdale Limestone has been quarried in this neighborhood continuously since the time of first settlement. In 1873, A. H. Worthen reported extensive local use of building stone—blocks and flagstone—taken from Chase's quarries, which were near this stop. He found the limestone beds cropping out in the open prairie, probably between here and Mud Run, the next creek about a mile to the north.

Quarrying has been carried on here for more than a hundred years for two reasons. First, the stone has been easy to find and work at its outcrops and under the thin cover of glacial drift. Second, the stone deposit is in the middle of a region that has no other source of building stone and crushed stone. Today, the only other quarries producing crushed stone in this region are from 40 to 60 miles away. Why? The region served by the Long Rock Quarry is underlain by rocks of the Pennsylvanian System, which contain few beds of limestone thick and extensive enough to maintain a modern quarry. In addition, glacial drift more than 25 feet thick covers most of the region, and quarries cannot afford to move overburden of such depth to mine limestone, a low-priced commodity.

<u>In the quarry</u>. Because the limestone occurs here as a thin bed, and the pit grows outward rapidly, surface mining is thus the most practical method of operation. As you drive through the quarry, observe the different phases of surface mining, or strip mining as it is sometimes called. The 3 to 8 feet of glacial drift covering the rock is stripped off by scrapers and bulldozers and stockpiled. Next a drilling rig bores holes down through the uncovered rock, and the holes are filled with explosive. Detonated, the explosive breaks the rock into pieces that can be loaded into trucks and carried to the crushing plant. In the primary and secondary crusher, the rock is broken and screened to make the different kinds of products.

<u>Limestone products</u>. In 1976, Illinois quarries produced 61,858,000 tons of limestone and dolomite (a rock very similar to limestone). The estimated value of this production was $141,441,000. (Samson and Dingwell, in press). In the field trip area, only Peoria County produced stone: 273,773 tons from this quarry with an estimated value of $711,800. The Long Rock Quarry produces agricultural limestone and several sizes of crushed stone that are used as compacted and loose construction materials. "Pit Rock," uncrushed stone as it comes from the quarry, is also sold.

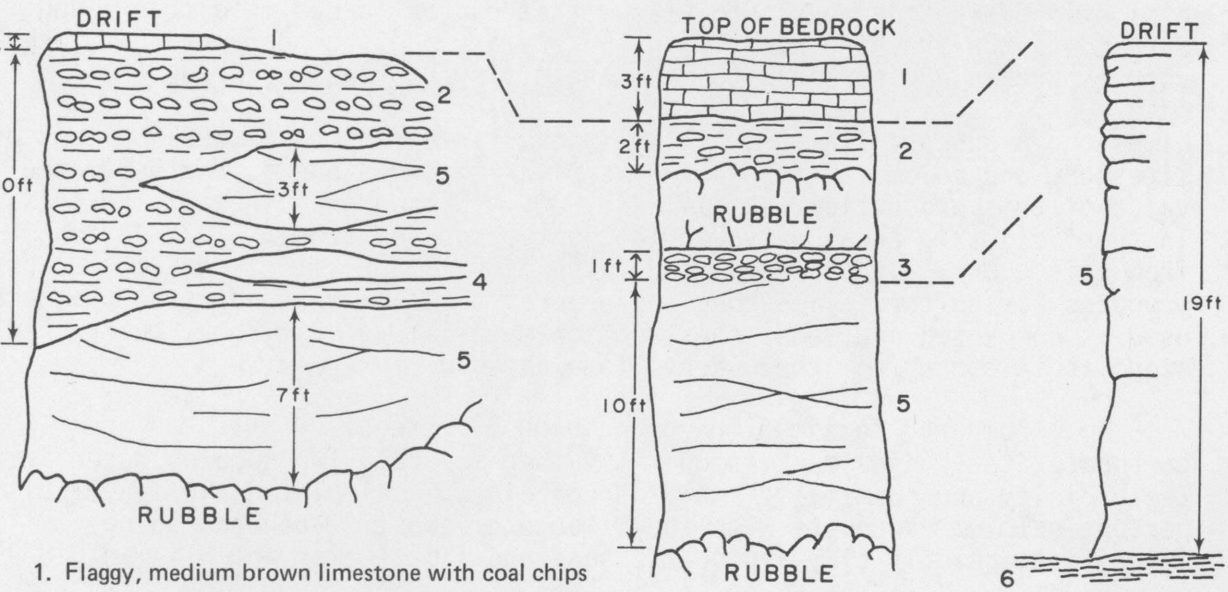
Compared to limestone containing 95 percent or more calcium carbonate, the Lonsdale Limestone is rather impure. Two samples taken in the vicinity and chemically analyzed contained a calculated average of 81 percent calcium carbonate with the balance of about 20 percent being impurities, chiefly clay and quartz sand and silt (Lamar and Willman, 1934).

(NOTE: You can detect the presence of quartz grains in the Lonsdale and other limestones—by rubbing a piece of the limestone on glass. If hard rubbing buffs a dull spot on the glass there are quartz grains scratching it and the limestone is sandy and impure. Calcium carbonate, the mineral calcite, the only component in pure limestone, is much softer than glass and does not scratch it. Therefore, very pure limestones do not scratch glass.)

The Lonsdale Limestone, like many other fine-grained, impure Pennsylvanian limestones, does not respond well to soundness tests, which are laboratory procedures that simulate repreated freezing and thawing of the stone. Because it crumbles too much under testing and exposure to weather, it is not used for concrete and bituminous aggregates.

The fossils. Figure 10 illustrates some of the different aspects of the Lonsdale Limestone that you can see exposed in the quarry walls. The light gray, massive limestone (Unit 5 in the figure) contains the fossils of sea animals: brachiopod shells, crinoid columnals, and corals. These animals lived in the chalky muds that accumulated here about 280 million years ago and in the water above the muds.

The black sea muds that are preserved as the very dark gray mudstone (Unit 6 in the figure) at the bottom of the quarry under the limestone, are generally covered with rubble. These sediments were evidently not occupied by many animals until just before the light-colored chalky mud deposition of the Lonsdale Limestone began. At this time, a rich habitat for some animals was created, so look for fossils in the very dark gray mudstone clinging to the sides of the big overturned limestone blocks. In the top inch or two, in places, horn corals, lumpy little colonial corals, brachiopods, crinoid skeletal parts, and even a shark's tooth have been found.



1. Flaggy, medium brown limestone with coal chips
2. Dark olive gray shale and mudstone with scattered limestone nodules and nodule layers
3. Loose and poorly cemented limestone nodules
4. Calcitic, massive, light olive gray mudstone
5. Massive, light gray, fine-grained limestone with curved partings; has medium gray nodule-like spots and fossils in places
6. Soft, very dark gray mudstone; shaly in places; many fossils in top inch or two in places

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Figure 10. Some different aspects of the Lonsdale Limestone in the Long Rock Quarry, Princeville.

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SURFICIAL GEOLOGY OF THE MIDDLE ILLINOIS VALLEY

Adapted from Plates 2 and 3 of Illinois State Geological Survey Circular 478, *Geology along the Illinois Waterway—A Basis for Planning* by H. B. Willman

Field Trip Guide Leaflet 1978C, October 14, 1978

Sediments which have been accumulating on the area's surface since the last glacier of the Wisconsinan Stage melted off it—about 16,000 years ago:

- Swamp and lake deposits. Mostly peat, peaty silt, and muck, interbedded in places with silt and fine sand. (Grayslake Peat)
- Alluvium. Deposits of modern rivers and streams in floodplains. Largely clayey silt and sandy silt with lenses of silty sand and gravel. (Cahokia Alluvium)
- Alluvial fans. Fan-shaped deposits of tributary streams on the floors of major valleys. Largely sandy silt interbedded with silty sand and fine gravel. (Cahokia Alluvium)
- Slopewash. Steep-sloped deposits along the base of bluffs. Largely clayey and pebbly silt with bedrock and drift materials; all washed and slumped from adjacent bluffs. (Peyton Colluvium)
- Wind-blown sand. Well-sorted medium sand in dunes and in sheet deposits between and near the dunes. (Parkland Sand)

Sediments deposited on the area's surface between the time the last glacier of the Wisconsinan Stage melted off and the time that large volumes of glacial meltwater stopped flowing down the Valley—the period between perhaps 16,000 and 13,000 years ago:

- Loess. Sheet deposits of clayey silt blown downwind out of the valley and onto the uplands. Not shown on the map but mainly covering the till areas. (Richland Loess on the Wisconsinan till; Peoria Loess on the Illinoian.)
- High-level terraces underlain by glacial outwash. Dominantly fine sandy gravel, pebbly sand, and coarse sand. (Henry Formation)
- Low-level terraces underlain by deposits of the Chicago Outlet River. Largely fine gravel. (Henry Formation)
- Deltas deposited in glacial lakes. Sandy fine gravel. (Henry Formation)

Sediment deposited on the area during the Wisconsinan Glacial Stage between about 75,000 and 16,000 years ago:

- Till. Mostly unsorted pebbly silty clay deposited by glaciers. Contains scattered cobbles and boulders and lenses of sand and gravel. (Wedron Formation)

Sediment deposited on the area during the Illinoian Glacial Stage which ended perhaps 175,000 years ago:

- Till. Generally like Wisconsinan till, above. In contrast to Wisconsinan tills, these sediments generally have deeper soils developed in them and thicker loess overlying them. (Glasford Formation)

Sediments deposited during the Pennsylvanian Period, which ended about 280 million years ago:

- Bedrock. Shale, sandstone, clay, coal, and limestone. (Carbondale, Modesto, and Bond Formations)

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